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THESIS  
FOR  
Degree M.S.  
IN  
NATURAL HISTORY  
SCHOOL OF

ILLINOIS INDUSTRIAL UNIVERSITY.

ON THE

GEOLOGY OF ARKANSAS.

H. S. Reynolds

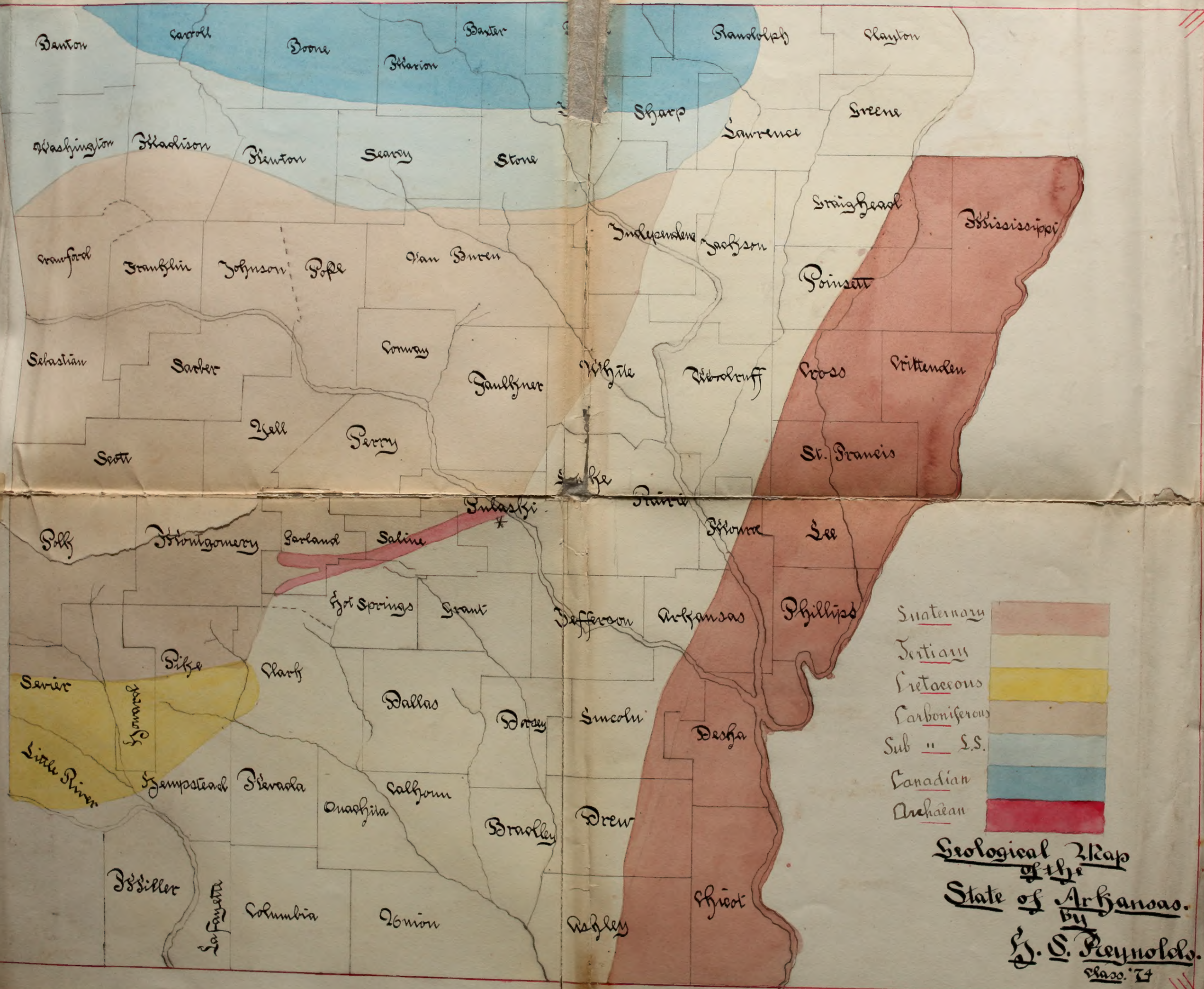
Class '74.



so.

lobo.







## 1 Historical Geology.

To obtain a knowledge of the resources of a state, either agricultural or mineral, we must have an insight into its geological structure. In a state with such a diversified surface as Arkansas it is extremely necessary that the farmer, mechanic, miner, or manufacturer, should know the portions of the state best adapted to their several vocations. For this purpose of gaining practical knowledge, I spent the summers of two years obtaining an insight into the geology of the state; the various rail roads kindly furnishing me with time-pases for the purpose.

I also received valuable hints from the "Reconnoissance of Arkansas," by D.D. Owen. The map which I have prepared to accompany this paper, indicates the relative positions of the various formations of the state; the exact boundary lines could not be made out unless a careful survey, and sectional maps were made.

The oldest rock exposed in the state is a hard, crystalline, unstratified one, protruded through the overlying strata. There are several areas of small extent scattered through the state.

The principal one is at Fourche Cove, Pulaski Co., just south of Little Rock. The strip of exposure is about four miles long from north to south, and two miles broad. It resembles a two pronged fork, as the name of the region indicates, and is composed principally of feldspathic rocks, with an elevation of about 300 feet, and is surrounded on all sides by tertiary deposits.





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The next locality of this rock is in Saline Co. south-west from the former one and of smaller area. The third outcrop is in Garland Co. at Magnet Cove where about four acres are covered with magnetic iron. There are many other minerals found here making this locality of very great interest to mineralogists.

The "Cove" is surrounded on all sides by crystalline and sub-crystalline rocks, one ridge extending to Hot Springs, twelve miles composed of a white novaculite rock. In Pike Co. two miles south of Murfreesborough there is a fourth exposure, consisting of green porphyritic stone some 200 yards in length north and south, bearing the sandstone, which rests upon it, up at an angle of about 45 degrees.

These isolated areas are undoubtedly the protrusion of the axis of disturbance in the state, and if a continuous line be drawn through them, we shall have the direction of upheaval from northeast to southwest.

The oldest sedimentary formation is found in the extreme northeast portion of the state in Clayton Co. far removed from the last named rock; evidently this state was not intended as a model for text-books to follow like New York. Where Crowley's Ridge strikes the St. Francis R. just after it issues from Missouri there occurs a quartzite sandstone of great hardness and micrometalline structure.

It has all the lithological characteristics of the Potsdam Sl. No fossils have been found in it, but the peculiar vermicular markings







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readily associate it with the above formation of H. W. and  
It is protruded through the late quaternary beds at an angle of about  
12 degrees, and the quaternary lies on its sides at about the same  
angle. Crowley's Ridge extends from Helena to the above point and  
this sandstone may form its nucleus the entire distance.

I have not represented this formation on the map, it is of so mythical  
a nature.

Along the northern border of the state, covering  
one tier of counties, and extending into the second tier, we find the oldest  
fossiliferous formation, a cherty magnesian limestone, with lithological  
character, and fossils placing it in the lower Silurian Age the calciferous  
epoch, a continuation of that formation from Missouri. In that  
state it reaches the maximum thickness of 1500 feet, but in Arkansas  
there seems to have been a thinning out of the series, as the greatest  
thickness observed has been but 300 feet, but as the underlying rock  
has nowhere been observed, we cannot infer this to be its entire thickness.

In Marion Co. on Sugar Creek we get the best section of the  
formation. It is of great economic value as this is the zinc bearing  
rock of the state. The mines located in this region are of great value  
and eventually will be worked extensively. There have been small  
quantities of lead and iron found, but none as yet extensively enough  
to pay for working. The soil is poor and will scarcely pay for tillage,  
but cattle might be raised profitably, as there is no lack of pasture.

The upper surface of this limestone seems to have been weathered very  
irregularly as the next rock varies greatly in thickness in very short distances.





There also seems to have been a very great elapse of time before this area was again submerged, and in condition for another rock formation.

No rocks of the upper Silurian or Devonian Ages have been identified, and if they exist at all are very insignificant.

In Independence Co. occurs the best section of the next formation belonging to the Carboniferous Age. A massive saccharoidal sandstone rests upon the Wagnerian Limestone, and varies much in thickness. In Independence Co. it is 75 feet thick, it rapidly increases in thickness westward, at Calico Rock on White R. it is 110 feet in thickness.

Its character and position shows it to be the same as the Blount Saccharoidal sandstone which there is 200 feet in thickness.

It belongs to the Sub Carboniferous Series, Its colors are quite striking ranging from white to brown.

Resting upon this sandstone is 470 feet of cavernous, or mountain limestone; some of its lower members, about 300 feet, have been named in Kentucky the "Barren Limestone" on account of the unproductiveness of the soil resting on these rocks. The rock is flinty and sub crystalline in structure. The beds of the remaining 170 feet are composed of a yellowish Archimedes Limestone.

The next 250 feet of rock is composed of various beds of shales, thin bedded limestones, and sandstones.

Upon this rests the far reaching Millstone Grit of the Carboniferous Series, extending over more than a third of the state, and varying greatly in thickness.





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We can hardly judge of its great development, over most of this vast area since it occupies the surface, and has been weathered and denuded in many places. In Dolk and Scott Co's the strata are upturned nearly to a vertical position, and we pass for miles across the upturned edges.

Dr Owen says: "My belief is that when it comes to be surveyed and measured in detail, it will be found to rival, in combined thickness, that of the great sandstone formation which girdles the shores of Scotland forming the southern flank of the Grampians." The lower members of this formation are quite shaly, and the lower sandstones are quite full of plants and animal fossils. In the counties bordering the limestone region a conglomerate is found capping the hills. Shales occur at the top in the counties along the Arkansas R. All the coal is referred to the Sub Conglomerate or False Coal Measures of some authors.

As in Kentucky and Tennessee however, good workable coals are found in this formation, and of excellent quality.

In Johnson, Pope, and Conway counties the thickest vein is about two feet, but in Sebastian Co. south of the Arkansas R. a vein occurs five feet thick. All the veins lie below the No. 1 coal of Kentucky (Owen). One peculiar feature about this "Grit" is the strange metamorphosis it has undergone in certain portions of the state.

In Hot Spring and Garland counties it has been changed to a white novaculite or hone-stone, known throughout the country as "Quachita Oil stone". A person can hardly believe that the huge





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cliff of pure white rock just north of Hot Springs, was once an ordinary sandstone. Heat, or hot vapor has probably done the work taking long ages to accomplish it. In the western counties of the state, we find in the upturned strata on the mountains, this same novaculite as huge walls occupying the places of sandstone layers, and enclosing the softer slates and shales. These hard walls usually form the mountain ridges, and the included shales have worn down and form the intervening valleys. The Crossatot Range is an example of this kind its altitude being about 1000 feet.

At one of the coal mines in Johnson Co. the strata above the coal amount to 1150 feet in thickness and topped with a conglomerate.

One proof that Arkansas has no true Coal Measures would be that in the Mississippi valley in Ill. Ind. and Mo. the Coal Measures lie unconformably upon the strata beneath whatever the underlying formation maybe. In Arkansas the underlying one would be the Sub Carboniferous, and the disturbance which tilted the strata of the state, probably came some before the time of the true Coal Measures and as we find the coal seams tilted with the rest and conformable with them we are forced to conclude that the coal belong to the false Coal Measures or sub conglomerate.

Throughout the state all the formations up to the close of Palaeozoic Time, are slightly tilted, some 1 to 3 degrees towards the southwest. The great development of the Williston Salt in this state can hardly be reconciled to the statement it is in





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Dana's Manual of Geology, 2<sup>d</sup> Edition, page 391 where he says this formation is nearly wanting in the Mississippi basin.

Shall we say that this state should be classed with the Appalachian region? This would seem to be indicated by the axis of disturbance which is parallel to the Appalachian trend.

Study this region as we will, the question comes vividly to our mind as to the origin of so much sedimentary deposit. Doubtless the shore to the north, the Wagonerian Limestone of the Silurian Age, and the Mountain Limestone of the Sub Carboniferous which had lately been deposited, gave much of this material. We find its thickness greatly increased towards the south and west, perhaps its own northern portions had to contribute to the deposits at the southwest, this is very probable as the higher mountains in the limestone region, are still capped with this formation, showing that denudation had done the work in the lower portions of the country.

The mountains of this state are mostly formed by table-lands being cut down, only a few at the west are formed by escarpments of tilted strata.

South of this formation we have the Cretaceous strata coming into the state from Texas and extending across the counties of Little River, Sevier, Howard and Pike and reaching into Clark nearly to Philadelphia. This area is something in the shape of a wedge with its base towards the west.





Rich farming lands cover this entire region owing to the fertility of the beds of fossil shells, which are found in abundance especially in the country twenty miles west of Philadelphia. The beds are over thirty feet in thickness. The various layers of this formation consist of marly limestones, grayish red clays, marls and argillaceous beds. Old geological maps extended this formation to the neighborhood of Jacksonport on the White R. The thickness of this formation has not been estimated, the thickest bed of fossils is about 60 feet.

The portion of the state lying contiguous to, and east of the St. L. & N. W. R. R., is covered by two formations, the Tertiary and Quaternary. There can be no line definitely drawn between them as they occur together over a large portion of this area.

The Tertiary is met with where the Quaternary is thin either on outcrops, or struck in wells &c. I have traced tertiary shells, marls, and sharks teeth, northward to Cabot 15 miles north of Little Rock, but Eocene sands and lignites occur in Clayton, and other northern counties, so I have felt justified in giving the tertiary a broad strip north and south on my map; after a careful survey has been made, we may possibly find the strip widened some at the south and contracted somewhat at the north. At White Bluffs Ark. some 70 feet of tertiary marls are exposed. Over the south-eastern portions of the state, the marls are found quite abundantly.





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The Tertiary in this state is of the Eocene epoch and probably covers a much greater area than at present as it shows marks of extensive denudation as in the neighborhood of Little Rock. It consists of alternating beds of lignites, sandstones, shales, gravels, orange sands, marls, clays and marls, limestones.

This formation extends into southern Illinois near Cairo. The Quaternary beds consist of lignites, ferruginous clays, sand cemented by iron into a soft sandstone, shell marls, clays, etc. Much of the material is from local drift as the sharp angular and often large stones testify. Nowhere in the state do we find the northern drift of the Glacial epoch.

This portion of the state is somewhat terraced into two broad terraces or levels, called locally the first bottom, and, second bottom.





Ages.	* Strata Periods.	of	Arkansas. Epochs.	Local Names.
Man.	Quaternary		Alluvial.	
Mammalian	Tertiary		Eocene	
Reptilian	Cretaceous		Upper	Eogyras bed.
Carboniferous	Carboniferous		Millstone Grit.	
				Coal
Silurian (Lower)	Sub Carboniferous		Upper	Mountain L.S.
				Barren L.S.
			Lower	Saccharoidal S.S.
	Canadian		Calceiferous.	Magnesian L.S.
	Cambrian ? Archaean		Dotsdam. ?	

\* Arranged according to Dana's Manual 3<sup>d</sup> Edition.





# Fossils of the Leading Formations

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Fossils of Magnesian Limestone

Fossils of Mountain Limestone

*Spirifer striatus*

" *expiratus*

Fossil Plants of Coal &c.

*Allethopteris nervosa*

*Annularia sphenophylloides*

*Calamites approximatus*

" *cuneatus*

*Cardiocarpon affine*

*Carpolithes platimarginatus*

*Cordaites borassifolia*

*Neuropteris fimbriata*

" *hirsuta*

" *tenuifolia*

*Rhabdocarpos minutus*

*Rhizolites palmatifida*

*Sigillaria reticulata*

*Sphenophyllum figureatum*

" *longifolium*

" *Schlotheimii*

Fossils in Willstone Grit. *Fucoides caudata* - *galei*, *Calamites sphenophyllus*

Fossils in Cretaceous Bed. *Exomura costata*, *Glyptaea Pichei*, *mutabilis*

*Ostrea cretacea*, *O. paleata*, *O. vermicularis*, *Pholadomya occidentalis*

Tertiary Fossils. *Monoceros retusus*, *Turritella plebeia*, *Carlita senaria*

*Corbula Alabamensis*, *Ancillaria subglobosa*, *Truncatella angustata*, *Sittonia*

*Euthera*, *Platycrinus*, *Cardium*

*Terebratula planumbona*

" *plana* *meata*

*Productus cora*

" *punctatus*

*Agassizocrinus conicus*

(*Serqueneus*)

*Asterophyllites equisetiformis*

*Blattina venusta*

*Diploleqium truncatum*

*Halonis pulchella*

*Hymenophyllites flexuatus*

*Lepidodendron vestitum*

" *modulatum*

*Lepidophlois irregulare*

*Lepidophyllum bifolium*

" *lanceolatum*

*Odonopteris intermedia*

*Sphenopteris dilatata*

" *decipiens*

" *Guthrieana*

" *obtusiloba*

*Staphulopteris stellata*

*Stigmara ficoides*





II. Mineralogy. The minerals of Arkansas are quite numerous and are interesting to study. One of the most remarkable localities is Magnet Cove, Hot Spring Co. where in a depression of some two miles in extent are found many kinds of minerals, (see catalogue).

This is the centre of disturbance for this region of country.

Another celebrated locality is the Crystal Mountain of Montgomery Co., where the joints of the massive sandstone have been permeated by alkaline silicious waters which have covered the sides of the crevices with 'bulliant'. I have seen wagons loaded with slabs of these sparkling crystals come into Hot Springs every day and offered for sale.

In all portions of this sandstone region crystallization is now going on, fresh quarried rocks of but two or three years exposure are covered with minute crystals.

The waters throughout the state have much silica in them and "mineral springs" are quite numerous.

Two mineral waters of White Co. came directly under my notice and yielded the following qualitative analysis:

Searcy Sulphur Spring

Free acid.	Trace
(Sulphuric acid,	"
Magnesia,	"
Iron	none
Sulphuretted Hydrogen,	some
Chloride of Sodium,	"
Calcic Carbonate	Trace

Judsonia Epsom Well.

Free acid	none
(Sulphuric acid	much
Magnesia	"
Iron	"
Sulphuretted Hydrogen	none
Chloride of Sodium	Trace
Calcic Carbonate	"





The most famous springs of the state are the Hot Springs of Garland Co. Here from the west side of a novaculite ridge some forty springs gush forth ranging in altitude one foot to ninety feet above the bed of the creek. The ledge itself is some 150 feet high, of beautiful novaculite. The springs have an elevated temperature some having heat enough to boil eggs soft, 148 degrees, Far.

Silica and lime are the principal mineral elements of the springs, their health giving qualities being principally due to their temperature and their skillful medical use. The "Arsenic" spring, largely used for drinking purposes, has not a particle of arsenic in it.

The cliff at the base of the springs is almost entirely made up of calcareous tufa, which through past ages has been deposited by the water.

The free carbonic acid of the water as it bubbles to the surface makes it a very agreeable beverage, and is drunk in great quantities by the inhabitants, and visitors of the city. The population is about 5000, half of whom are transient ones. The hot douches and vapor baths are powerful agents and must be used under medical advice.

Various conjectures have been made as to their elevated temperature the best one seems to be that the water somewhere in their passage come in contact with hot vapors issuing from fissures in the interior of the mountain, and come to the surface, heated by, and permeated with these vapors and gases. The springs are on Government Reservation and free to the public. Hundreds of invalids, too poor to live in the city camp out on the hillside, and avail themselves of the health-giving springs.





# Minerals of Arkansas.

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	Minerals of Arkansas.					
	Name	Common Name	Locality	Name	Common Name	Locality
I	Antimony		Sevier County	Isidomelane	Manganese Oxide	Sharp Co.
II	Argentite	Silver Sulphide	Dulaski " &c	Wad	" Nickel	" " "
	Galenite	Lead " "	" " "	Quartz	agate	Wagon " Core
	Sphalerite	Zinc Blende	Marion " "	Quartz	Crystal	Montgomery Co.
	Chalcocite	Cupric Sulphide	Dulaski " "	Quartz	Smoke " "	" " "
	Syrite	Iron " "	Wagon Core	Omphacite	Augite	Hot Springs
III	Embolite	Bromide, Silver	Montgomery Co.	Idymite	Indian Stone	" " "
	Halite	Common Salt	Saline Co. &c	Sulfoxine		Wagon Core
	Cerargyrite	Silver Chloride	Montgomery Co.	Amphibole	Actinolite	" " "
V	Zincite	Zinc Oxide	Independence " "	Garnet		" " "
	Massicot	Lead Oxide	" " "	Episote		" " "
	Hematite	Iron " "	Dulaski Co. &c	Muscovite	Wick	" " "
	Perovskite	Lime & Titanic	Wagon Core	Nephelite	Elucolite	" " "
	Magnetite	Lode-Stone	" " "	Schorlomite		" " "
	Rutile	Titanic Oxide	" " "	Calamine	Zinc Silicate	Sharp Co. &c
	Brookite	" " "	" " "	Thomsonite	" "	Wagon Core
	Hydrotitanite	" " "	" " "	Talc	Sedgestone	" " "
	Braunite	Manganese " "	Sharp County	Serpentine		Hot Spring
	Synchysite	" " "	" " &c	Kaolinite	Potter's Clay	Benton
	Wanganite	" Hydrate	" " "	Wavellite		Montgomery Co.
	Limonite	Iron Hydrate	Dulaski " "	Mitre		In Caves
	Limnate	Boa Iron	" " "	Barite	Heavy Spar	Sharp Co.





# Minerals of Arkansas.

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<u>Name</u>	<u>Common Name</u>	<u>Locality</u>
Selenite	Gypsum	Sike Co. &c.
Calcite	Calc Spar	Sharp " "
Dolomite	Pearl "	" " "
Siderite	Spathic Iron	Dulaski Co.
Dragonite		Hot Springs
<b>VII</b> Succinite	Amber	Soinzette Co.
Coal		Sebastian " &c.
Lignite	Fossil Wood	Clayton " "
Semi Anthracite		Conway " "

<u>Name</u>	<u>Common Name</u>	<u>Locality</u>
<u>Tangue Rocks.</u>		
Limestone		
Dolomite		
Basalt		
Sandstone		
Conglomerate		
Horaeulite	Hone Stone	
Quartzite	Quartz Rock	
Argillite	Slate	
Marble		
Shale		
Suenite		
Granite !		
Slate.		









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